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IMPLEMENTATION COMPLETION REPORT

KOREA

PETROLEUM DISTRIBUTION AND SECTOR MANAGEMENT IMPROVEMENT PROJECT
(LOAN NO. 3613-KO)

June 4, 1999

Energy and Mining Sector Unit
East Asia and Pacific Region

CURRENCY EQUIVALENTS

(As of December 31, 1998)

Currency Unit	=	Korean Won (KRW)
KRW1.00	=	US$0.0008268
US$1.00	=	KRW1209.5

FISCAL YEAR OF BORROWER

January 1 to December 31

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
bpd	barrels per day
CSN	Country Strategy Note
DOPCO	Daehan Oil Pipeline Corporation
DSM	Demand Side Management
DSR	Debt Service Ratio
ICR	Implementation Completion Report
IRR	Internal Rate of Return
MIS	Management Information System
MOCIE	Ministry of Commerce, Industry and Energy
SAR	Staff Appraisal Report
TOR	Terms of Reference

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Table of Contents

IMPLEMENTATION COMPLETION REPORT
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Preface

This is the Implementation Completion Report (ICR) for the Petroleum Distribution and Sector Management Improvement Project in the Republic of Korea, for which Loan 3613-KO in the amount of US$120 million equivalent was approved on June 30, 1993, and made effective on September 13, 1993.

Loan 3613-PH was closed on December 31, 1998, compared with the original closing date of June 30, 1996. Final disbursement took place on April 30, 1999.

The ICR was prepared by Calum Gunn, Consultant, EASEG, under the supervision of Mohammad Farhandi, Principal Energy Specialist, Energy and Mining Sector Unit of the East Asia and Pacific Region. It was cleared by Yoshihiko Sumi, Sector Manager, EASEG.

Preparation of this ICR was begun in January 1999 followed by an ICR mission in February 1999. It is based on material in the project file as well as data provided by the Borrower. The Borrower contributed to the preparation of the ICR by stating their views as reflected in the mission's Aide Memoire (Appendix A), by preparing their own evaluation of the Project's execution (Appendix B), and by commenting on the draft ICR (Appendix C).

IMPLEMENTATION COMPLETION REPORT
KOREA
PETROLEUM DISTRIBUTION AND SECTOR MANAGEMENT IMPROVEMENT PROJECT
(Loan No. 3613-KO)

Evaluation Summary

Introduction

i. In August 1991, in the context of Korea's graduation discussions, the Government of Korea and the Bank agreed that each project in the final cluster of Bank operations would have to include a value-added component with a major impact on sectoral policies, in order to justify Bank participation. In the energy sector, the Government indicated that the Bank could add value by helping to improve energy conservation measures in Korea, and proposed that the Bank's financial support could be directed toward a nationwide pipeline project for the transportation of petroleum products, to be implemented by the Daehan Oil Pipeline Corporation (DOPCO). The existing petroleum transportation system, predominantly served by coastal vessels, road trucks and rail tankers, was seen as adding to the congestion of the country's transportation infrastructure, being unreliable and inflexible, contributing to atmospheric and marine pollution, and creating safety hazards. The new pipeline system was designed to transport more than half of the demand for light petroleum products (i.e., gasoline, jet fuel, kerosene and diesel oil), from refineries mainly in the south, to markets mainly in the north, hence considerably alleviating these problems. Further, pipeline transportation was considered to be more economic over long distances than alternative transportation modes.

Project Objectives

ii. **Physical and Environmental Objectives and Project Rate of Return.** Overall, at appraisal, the project design was considered sufficient to help the Government address issues which might otherwise have not received proper attention, particularly because the Bank was the only remaining official source of external assistance and advice. The Project's main objective was to improve the efficiency of Korea's energy sector and enhance the reliability of petroleum supply. Specific objectives included (a) establishing a more efficient and reliable petroleum supply and distribution system, through the construction of a pipeline system of approximately 1,000 km to transport light petroleum products, and (b) as a result of the utilization of the pipeline, improving environmental quality and safety levels, by reducing air and water pollution and by reducing road and rail hazards.

iii. The objective of enhancing the efficiency and reliability of the petroleum supply and distribution system, with resultant economic, environmental and safety benefits, has only been partially achieved. The pipeline system itself has been completed, although final commissioning was delayed by more than two years, mainly due to problems experienced by DOPCO in acquiring land associated with the network's largest offloading and storage terminal. Nevertheless, although the network itself has been successfully completed, it is being operated at well below the expected capacity utilization factor. At appraisal, it was projected that by 1998 the entire pipeline system would be handling about 470,000 bpd of light petroleum products, whereas the actual figure is closer to 220,000 bpd. Consequently, rather than accounting for the expected 53 percent of the market for transporting light petroleum products, by late 1998,

DOPCO was serving only 30 percent. The current and projected low level of pipeline utilization through to 2004, has had a detrimental impact on the Project's economics and also on DOPCO's finances (the economic and financial internal rates of return, IRR, have reduced from 14.5 percent to 6.8 percent, and from 12.5 percent to 4.3 percent, respectively). Therefore, the Project has not resulted in the originally expected level of efficiency, reliability, environmental or safety benefits, because considerably less coastal vessels, trucks and rail tankers have been displaced by the operation of the pipeline than was projected.

iv. **Institutional Development Objective**. The Project also had the objective of improving sector institutions by strengthening the financial, operational and managerial capabilities of DOPCO, and this objective has been achieved. Technical assistance was provided to DOPCO to help design and implement a management information system (MIS), and also to train DOPCO staff in critical operational areas. DOPCO proceeded with the development of the MIS as originally envisaged, and about 50 DOPCO staff attended various technical and non-technical training courses. Furthermore, Bank involvement provided support to DOPCO's institutional development over and above the specific institutional project objectives, with respect to environmental and safety issues, and also in the preparation of a management program and strategic plan.

v. **Sectoral Development Objective**. The Project's sectoral objective of developing an appropriate energy conservation program, with a strategy to sustain it, was the key justification for Bank involvement. This objective was to be achieved through a major Energy Conservation Study, which was to include an action plan that could be subsequently implemented by the Government, within the framework of a sound pricing policy for energy products. Although this Study was completed, albeit with a substantial delay requiring a 30 month extension to the loan closing date, the related policy objective can only be rated as having been partially achieved, since the development impact of the Study has been modest. This is partly because the institutional environment relating to the energy sector is changing rapidly, precluding the immediate adoption of any action plan concerning energy conservation measures, but also because the Study provided few detailed and implementable recommendations.

vi. **Major Factors Affecting the Project**. The most important factor detrimentally affecting the Project has been the incapacity of DOPCO to reach agreements with the refineries (being both shareholders of DOPCO and users of the pipeline) on the utilization of the pipeline network, since this has reduced DOPCO's market share significantly below expectations. The impact of the regional crisis, combined with the low world price of crude, have meant that the refineries are facing low operating margins, and as such have most likely been evaluating the merits of alternative product transportation modes based on cash cost alone, consequently disadvantaging utilization of the pipeline network. Furthermore, the crisis not only reduced the market share of light petroleum products transported by pipeline, but also caused a drop in Korea's overall petroleum demand. In addition, project implementation delays detrimentally impacted the revenue stream associated with pipeline operation, and also resulted in the final commissioning coinciding with the onset of the crisis, which may have affected the ability of the refineries to switch modes of transportation.

vii. A key factor affecting the progress and output of the Energy Conservation Study was the multiple reorganizations of the Ministry of Commerce, Industry and Energy (MOCIE), the Ministry responsible for energy conservation. The frequent changes of staff responsible for overseeing the Study delayed its completion significantly, and did not ensure a consistent commitment to addressing some key issues, most notably energy product pricing. This made it

difficult for an agreement to be reached between the Bank, MOCIE and DOPCO, on a suitable TOR for the Study. Furthermore, the ongoing reorganization of MOCIE and other sector entities will most likely involve the separation out of policy functions vested within the energy sector corporations, including many energy conservation activities. No decision has yet been made on how such activities would be consolidated with similar functions currently vested within the Ministry and other Government entities. Therefore, it is likely that this current state of flux within the sector would have precluded immediate adoption of many of the recommendations outlined in the Energy Conservation Study, even had such recommendations been more targeted.

Overall Outcome and Bank/Borrower Performance

viii. **Bank Performance**. Bank performance in identifying, preparing, appraising and supervising the Project was satisfactory. Project design was consistent with the Bank's country assistance strategy, including the requirement to include a substantial value-added component. The problems that later beset the Project were not foreseeable, and additional resources for supervision would have had little impact on resolving either the difficulties experienced between DOPCO and the refineries, or the delays experienced in acquiring land. Nevertheless, the Bank did take a number of measures with respect to the Energy Conservation Study. These included: (i) providing a number of TORs for the Study in an attempt to elicit action; (ii) numerous communications with DOPCO and MOCIE, making it clear that successful completion of the Study was critical to a satisfactory outcome for the Project as a whole; (iii) attempting to apply direct leverage by indicating that DOPCO's request to utilize part of the Loan to cover a number of self-financed project components, would not be considered until after work had begun; and (iv) ensuring that the key issue of energy product pricing remained firmly within the Study's scope of work.

ix. **Borrower Performance**. DOPCO's performance during preparation and implementation of the project was satisfactory. DOPCO took into account the Bank's recommendations relating to project design, particularly with respect to environmental and safety aspects. Subsequent factors that detrimentally affected project outcome were primarily outside of DOPCO's control. Further, with respect to the progress and quality of the Energy Conservation Study, DOPCO staff were not in a position either to scope or closely monitor the study, and were therefore dependent on cooperation from MOCIE. MOCIE's commitment to the Study, and to addressing issues such as pricing, was not consistent during the course of the Project. However, commitment to expediting the completion of the Study improved markedly during the last 18 months of project implementation as a result of MOCIE's most recent reorganization.

x. **Project Sustainability**. Overall, project sustainability is rated as likely. Although the sectoral objective relating to the development of an energy conservation strategy, within the framework of a sound pricing policy for energy products, has not been achieved, the prospects for the development of such a strategy in future are considered to be likely. The implementation of any future energy conservation measures and reforms of the energy product pricing structure will to a large extent be dependent on the sector structure resulting from current reform initiatives. However, the Bank's preliminary review of the Government's restructuring plans, particularly with respect to the power sector, indicates that the reform framework is sound, well-developed and ambitious.

xi. With respect to the sustainability of the project objective to enhance the efficiency and reliability of the petroleum supply and distribution system, with resultant economic, environmental and safety benefits, this depends on the future capacity utilization of DOPCO's

pipeline system. Although the present level of pipeline utilization is unsustainable, it is projected that, in the medium to longer term, the throughput of petroleum products in the system will rise to the levels expected at appraisal. This is because current projections suggest that the growth rate of petroleum product demand in Korea will soon return to pre-crisis levels, and the underlying economics of pipeline utilization versus alternative transportation modes has not changed significantly since appraisal. Therefore, apart from the substantial environmental and safety benefits that would accrue from increased transportation of petroleum products by pipeline, the Government still has a clear economic motivation for encouraging greater utilization of DOPCO's pipeline system. Once the impact of the crisis on the cash position of the refineries has subsided, it is considered likely that all parties will reach an agreement on a greater level of pipeline utilization, particularly because the refineries are not only users of the pipeline, but are co-owners of DOPCO along with the Government. Hence, the long term sustainability of the pipeline system is considered to be likely.

xii. **Assessment of Outcome.** The overall outcome of the Project is unsatisfactory. The low utilization of the pipeline network has resulted in a less than satisfactory IRR for the Project, and lower than expected environmental benefits. Furthermore, the Project's value-added objective, the actual implementation of an energy conservation program within the framework of a sound pricing policy for energy products, has not been achieved. Nevertheless, this unsatisfactory project outcome is to some extent offset by the likelihood of long-term project sustainability and the high probability that the energy conservation and product pricing study provide guidance and inputs into the sectoral reform process.

Future Operation and Key Lessons Learned

xiii. **Future Operation.** DOPCO's action plan to address its current difficulties, in order to ensure the future sustainability of its operation, comprises: (i) increasing sales volume, as a result of joint negotiations between DOPCO, the Government (as majority shareholder) and the refineries (being both users and minority shareholders); (ii) improving the Corporation's financial structure, by seeking debt/equity conversion and temporary debt forgiveness from the Government; and (iii) making the Corporation's management system more efficient, through restructuring and downsizing. MOCIE is coordinating the ongoing negotiations between DOPCO and the refineries, since the Government has a strong motivation to increase capacity utilization of the pipeline network in the national interest, for environmental and economic reasons. Preliminary indications are that the refineries will agree to a three year transition period during which utilization of the pipeline will be gradually increased.

xiv. **Key Lessons Learned.** Firstly, the experience gained in this Project re-emphasizes the importance of having a consistent Government commitment to addressing sector issues. In the absence of MOCIE's consistent commitment, the Loan was structured in such a way as to provide little incentive to MOCIE to facilitate progress on the Energy Conservation Study, the Project's key value-added component. One possible approach might have been to directly loan the funds for the Study to MOCIE, and further to link this to an additional component that could potentially have been used as an incentive to make progress on the Study (e.g., training for MOCIE staff). Secondly, the poor rate of return achieved by the pipeline network indicates that the success of even the most apparently financially-viable project can be partly undermined by unforeseen exogenous factors, in this case the regional crisis (and, to some ex tent, the currently low price of oil).

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PART I: IMPLEMENTATION ASSESSMENT

A. STATEMENT/EVALUATION OF OBJECTIVES

1. **Background**. In August 1991, in the context of Korea's graduation discussions and a plan to phase out Bank lending by 1995, the Government of Korea and the Bank agreed that Bank operations in Korea during this period would have to include a value-added component with a major impact on sectoral policies, in order to justify Bank participation. Within this framework, the Government proposed a number of projects for Bank support, including the development of a nationwide pipeline project for the transportation of petroleum products, to be implemented by the Daehan Oil Pipeline Corporation (DOPCO). Initial discussions between the Bank and the Government, regarding possible value-added components to be associated with this project, focused on developing a sustainable implementation strategy for petroleum industry deregulation (including an evaluation of the regulatory structure) and improving the effectiveness of energy conservation initiatives. Subsequently, during preparation and appraisal of the Project, the Government made it clear that its priority was on the latter, and requested that the Bank advise on a course of action to slow the consumption of energy and to stop the deterioration of energy conservation measures. Any issues regarding petroleum deregulation were to be dealt with in this context, although the Ministry of Commerce, Industry and Energy (MOCIE)[1] indicated that it had no objection to addressing the decontrol of energy product prices.

2. With respect to the physical aspects of the proposed pipeline project, the Government's concept had arisen because the existing petroleum transportation system was causing a number of problems. At the time, most of the refining capacity was located in the south, whereas more than 40 percent of the market for petroleum products was in the north, in the Seoul Metropolitan Area. Only about 10 percent of petroleum products were carried by the existing limited pipeline network, with the majority by coastal vessels, road trucks and rail tankers. These modes of transport were seen as: (i) adding to the congestion of the country's transportation infrastructure (particularly roads and port facilities); (ii) being unreliable and inflexible, particularly during periods of high demand and inclement weather; (iii) contributing to atmospheric and marine pollution (due to CO_2, NO_x and SO_2 emissions from road and rail transport, and oil leaks from coastal vessels); and (iv) creating safety hazards from shipping and truck accidents. The proposed pipeline system was designed to transport about 55 percent of the demand for light petroleum products (i.e., gasoline, jet fuel, kerosene and diesel oil), hence considerably

[1] During the course of the Project the Ministry responsible for the energy sector changed from: the Ministry of Energy and Resources; to the Ministry of Trade, Industry and Energy; and finally to the Ministry of Commerce, Industry and Energy (MOCIE). It is by this latter name to which the Ministry is referred throughout this ICR, irrespective of the relevant date.

alleviating these problems. Further, pipeline transportation was recognized as being more economic over long distances than alternative transportation modes.

3. **Project Objectives.** As stated in the Bank's Staff Appraisal Report (SAR) of May 12, 1993, the objective of the Project was to improve the efficiency of Korea's energy sector and enhance the reliability of petroleum supply. This was to include: (a) establishing a more efficient and reliable petroleum supply and distribution system through the construction of a pipeline network; (b) improving environmental quality and safety levels[2] by reducing air and water pollution and by reducing road and rail hazards; (c) developing an appropriate energy conservation program (with a strategy to sustain it); and (d) improving sector institutions by strengthening the financial, operational and managerial capabilities of DOPCO.

4. **Project Components.** The Project comprised three components: (i) a pipeline system of approximately 1,000 km to transport light petroleum products; (ii) a major study on energy conservation which was to include an action plan that could be subsequently implemented by the Government; and (iii) technical assistance to DOPCO, which involved helping to design and implement a management information system (MIS), and also training DOPCO staff in the critical areas of operations, finance and management.

5. The pipeline system includes the South-North segment comprising: an east-north trunkline that connects two eastern refineries near Pusan (Yukong and Ssangyong) to Taejon (300 km); a west-north trunkline that connects the Honam refinery at Yeochon to Taejon (275 km); and two parallel pipelines from Taejon to Seoul (141 km each). The system also includes two short segments, a spur off the South-North segment linking Kwangju to Koksung, and a separate segment connecting the Kyungin refinery at Inchon to Seoul and Kimpo. In addition, the system involves storage tanks, pumping stations and loading and unloading facilities. The largest offloading and storage sites are located at the Taejon and South Seoul Terminals.

6. **Evaluation of Objectives.** The project design in the SAR was consistent with the Bank's strategic objectives specific to the energy sector (i.e., improving sectoral efficiency and strengthening institutions) as well as the wider objectives (e.g., environmental protection) outlined in the Country Strategy Note (CSN) for Korea. The CSN reiterated and re-emphasized the policy that Bank operations in the period leading up to Korea's graduation should add value beyond the financial transfer itself. Hence, although there was a significant financing gap associated with the Project, the sectoral objective of developing an implementable and sustainable energy conservation program was the key justification for Bank participation.

7. Whether the Bank's involvement in the development of such an energy conservation program was considered to provide sufficient value-added content to the Project was a matter for debate at Board presentation; doubt was expressed that, without Bank involvement, the Government would not have developed a similar program itself in any case. Nevertheless, in hindsight, the subsequent reluctance of MOCIE to address issues such as energy product pricing (para. 21), provides credence to the view that the Bank's involvement could potentially have added significant value to the design of Korea's energy conservation program, had sufficient incentives been incorporated into the project design to facilitate progress (para. 34). Although

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[2] The actual word used in the SAR was "standards". However, improving environmental quality and safety "levels" was the intention.

the scope of the sectoral objective became more modest from identification to appraisal (para. 1), the focus did remain firmly on action rather than simply analysis; hence the Loan Agreement included a covenant requiring the Government to implement the measures and recommendations of the action plan arising from the study on energy conservation.

8. The Project's objectives to enhance the efficiency and reliability of the petroleum supply and distribution system were linked to clearly identifiable economic, environmental and safety benefits (para. 2), although the achievement of these benefits was not dependent on Bank involvement. On the other hand, the institutional objective was seen as being another area where the Bank could add some value, and the design of the proposed technical assistance component for DOPCO was adequate for this purpose. Overall, the project design was considered sufficient to help the Government address issues which might otherwise have not received proper attention, particularly because the Bank was the only remaining official source of external assistance and advice (since ADB and OECF were no longer active in the country).

B. ACHIEVEMENT OF PROJECT OBJECTIVES

9. **Physical and Environmental Objectives**. The objective of establishing a more efficient and reliable petroleum supply and distribution system, with resultant economic, environmental and safety benefits, has only been partially achieved. The pipeline system itself has been completed, although final commissioning was delayed by more than two years. By the time of Board presentation, the Kyungin segment had already been completed (December 1992), and DOPCO had scheduled completion of the remainder of the pipeline system for the end of December 1994. The Bank felt that a more realistic completion date for the South-North segment would be June 1995, and in fact the Taejon Terminal and the sections of the network south of this point were completed in that month. However, although about 90 percent of the lands and rights-of-way required had been purchased prior to Board presentation, this did not include the land required for the South Seoul Terminal. Significant problems were subsequently experienced by DOPCO in purchasing the land associated with this critical terminal, and groundbreaking at the site could not begin until April 1995, at which stage the Project was more than 75 percent complete overall. Because of the problems relating to the South Seoul Terminal, full completion of the pipeline system was delayed until July 1997, necessitating an 18 month first extension of the Loan from June 30, 1996, to December 31, 1997.[3]

10. Nevertheless, although the pipeline system itself has been successfully completed, it is being operated at well below the expected capacity utilization factor. Although the short Kyungin segment of the network has operated since 1994 at acceptable levels (increasing from 80,000 to 100,000 bpd, which corresponds to a capacity factor of 60-75 percent), the South-North segment has continually been significantly underutilized. In the sections of the South-North segment south of Taejon, the capacity factor was 34 percent in 1997, dropping to 28 percent by late 1998. In the Taejon to Seoul sections, the capacity factor in late 1998 was only 19 percent. At appraisal, it was projected that by 1998 the entire pipeline system would be handling about 470,000 bpd of light petroleum products, whereas the actual figure is closer to 220,000 bpd. Consequently, rather than accounting for the expected 53 percent of the market for transporting light petroleum products, by late 1998, DOPCO was serving only 30 percent.

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[3] This extension would have been required in any case due to the delays experienced in the preparation of the Phase II Energy Conservation Study (para. 15).

11. Furthermore, DOPCO's current forecasts for system operation (Statistical Annexes, Table 9), do not reach a level of 470,000 bpd until 2004. This low level of pipeline utilization has had a detrimental impact on the Project's economics (para. 12) and DOPCO's finances (Statistical Annexes, Table 6), and has not resulted in the originally expected level of efficiency, reliability, environmental or safety benefits, because considerably less coastal vessels, trucks and rail tankers have been displaced by the operation of the pipeline than was projected. In addition, the low capacity factor has detrimentally affected the quality of transportation service in the South-North segment, evidenced by a significant increase in product transit time through the pipeline.[4] During off-peak periods, pipeline transit time can be as much as 10 days, whereas coastal vessels can ship the product within a day.

12. **Economic and Financial Internal Rates of Return**. The lower than expected utilization of the pipeline system (para. 10) has detrimentally affected the economic and financial internal rates of return (IRR) for the Project. In the SAR, these IRRs were estimated to be 14.5 percent and 12.5 percent respectively. The IRRs have been recalculated on the basis of actual project investment costs and revenues to date, as well as DOPCO's current forecasts for sales, revenues and operating costs. The updated values are 6.8 percent and 4.3 percent for the economic and financial IRR respectively (Statistical Annexes, Table 9).

13. **Institutional Development Objective**. The Project's institutional objective has been achieved. About 50 DOPCO staff attended various technical and non-technical training courses through the use of the Loan. With respect to MIS, DOPCO did not utilize the portion of the Loan allocated for this purpose, since Bank procedures for the hiring of consultants, particularly for relatively small contract amounts, were seen as cumbersome. However, DOPCO did proceed with the development of the MIS as originally envisaged, although this component was self-financed. Bank involvement also provided support to DOPCO's institutional development over and above the specific institutional project objectives, with respect to environmental and safety issues (para. 27), and also in the preparation of a management program and strategic plan (para. 28).

14. **Sectoral Policy Objective**. The sectoral policy objective was only partially achieved. This objective was to be achieved through a major consultancy Study on energy conservation in Korea comprising two phases. The successful completion of Phase I was a condition of Board presentation, and this phase was intended to: (i) characterize energy use in Korea; (ii) review existing conservation efforts and analyze the reasons for the slowdown of existing efforts; (iii) broadly identify areas which would lead to a reduction in energy demand with an estimate of the potential savings for each; and (iv) to develop prioritized conservation programs including TORs for Phase II. Any broad strategy was intended to be based on developing a sound pricing policy for energy products. However, the Consultant's report submitted for Phase I focused primarily on outlining an action plan involving the development of planning and monitoring systems. The report lacked a consistent set of conservation potential estimates which could be used to identify specific program opportunities or targets, and the material included on institutions and pricing was considered to be highly theoretical.

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[4] The pipeline handles four types of petroleum products, and each type of product is shipped through the pipeline in batches. When the batches are pumped through the pipeline, interfaces form at each of the product joints, and the amount of product contamination at the interfaces increases with the number of batches. Hence, to reduce contamination, products must be stored until sufficient quantities are available to make sufficiently large batches.

15. Notwithstanding this somewhat disappointing result, the Phase I action plan was nevertheless deemed acceptable by the Bank and the Government. An initial TOR for Phase II was subsequently developed by the Bank with the intention to extend the action plan presented in Phase I by identifying: (i) more in-depth policy and program actions; (ii) required changes to policy, institutional roles and implementation mechanisms; and (iii) necessary monitoring, evaluation and compliance mechanisms. However, after the Project became effective in September 1993, problems were experienced in preparing the TOR for Phase II (para. 21), and the TOR was not completely finalized until early 1998. The final TOR comprised the following tasks: (i) an evaluation of energy pricing in Korea; (ii) the development of a methodology for energy conservation evaluation; (iii) the preparation and execution of an intensive energy conservation training workshop for MOCIE staff; (iv) the development of an effective demand side management (DSM) approach for Korea's transportation sector; (v) an evaluation of energy conservation programs; and (vi) the development of a management program and strategic plan for DOPCO. In addition to the difficulty in finalizing the TOR, there were problems experienced in selecting the Consultant. Consequently, completion of the Phase II report was delayed significantly, and this resulted in the need for a second extension of the Loan closing date by one year to December 31, 1998.[5]

16. Although both Phase I and Phase II of the Energy Conservation Study have now been completed,[6] the related policy objective can only be rated as having been partially achieved, since the development impact of the Study has been modest. This is partly because the institutional environment relating to the energy sector is changing rapidly, precluding the immediate adoption of any action plan concerning energy conservation measures (para. 21), but also because neither report provided much in the way of detailed and implementable recommendations. Nevertheless, MOCIE have indicated that in the final Phase II report: (i) the analysis model and discussion on energy pricing will help MOCIE's establishment of energy pricing policy in the near future; (ii) Korea-specific, usable methodologies for energy conservation analysis, and procedures for their planning, implementation and evaluation are presented; and (iii) foreign experiences with DSM in the transportation sector are provided as good case studies for the introduction of Korea's own policy.

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[5] Originally, appointment of the Consultant for Phase II was expected in July 1994. However, DOPCO, as the Project's implementing agency, did not have the requisite staff to be able to prepare a more detailed TOR based on outlines provided by the Bank, and were dependent on input from MOCIE. The substantial delays experienced in preparing the TOR (para. 21) meant that the letter of invitation (LOI) was not issued until November 1996, but the Bank required a reissuance since only one proposal was received (from the Consultant that had prepared the Phase I report). The LOI was reissued in March 1997, and this time three proposals were received. Given that this provided insufficient time to complete the study, approval to award the contract (to the same Consultant as for Phase I) was withheld until it was clear that the Loan would be extended for a second time.

[6] The final draft report was submitted during December 1998, and subsequently the Bank received comprehensive comments from MOCIE on the relevant sections of the report in January 1999. The Bank considered that MOCIE's comments were significant enough to be taken into account in the final version, and hence provided its no objection to the final report being submitted in March 1999, on the condition that this did not impact on the consultancy fee.

C. MAJOR FACTORS AFFECTING THE PROJECT

17. **Lack of Satisfactory Agreements Between the Refineries and DOPCO.** The incapacity of DOPCO to reach agreements with the refineries on the utilization of the pipeline network has been the most important factor detrimentally affecting project outcome, since it has reduced DOPCO's market share significantly below expectations. Consequently, DOPCO has received insufficient revenue to meet its significant debt service obligations. On the face of it, the difficulty in reaching understandings with the refineries seems unusual, particularly given that (a) utilization of the pipeline was expected to be governed by take-or-pay agreements (para. 26), and (b) the refineries are themselves shareholders in DOPCO,[7] and as such would seem not to be acting in their own interests. This is not only from an equity value standpoint, but also from a technical standpoint, given the service problems associated with the low utilization of the pipeline (para. 11). A full explanation of the behavior of the refineries would require an understanding of the incentives and constraints to which they are subject, and of their competitive and strategic position, particularly with respect to their use of coastal vessels. However, two key factors influencing the behavior of the refineries can be identified: (i) the low world price of oil, since this will have lowered the operating costs of other transportation modes, possibly making these alternatives more competitive in the short-term (especially when compared solely on a cash basis); and (ii) the impact of the regional crisis.

18. **The Regional Crisis.** The regional crisis has caused a drop in Korea's petroleum demand,[8] and this combined with the currently low price of oil has meant that the refineries have faced low operating margins.[9] Refineries have most likely been evaluating the merits of alternative product transportation modes based on cash cost alone, and this has disadvantaged utilization of the pipeline network. Moreover, since the onset of the crisis, the refineries have not been well placed to switch to pipeline use from other transportation modes. This is because the crisis has raised barriers to exit from the petroleum product transportation market (for alternative

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[7] At appraisal, DOPCO was 50.8 percent owned by the Government, and the minority shareholders were the five private-sector refineries intending to use the pipeline, each with an 8.2 percent stake, and two airline companies with 4.1 percent each. As of December 31, 1997, the Yukong (SK), Honam (LG Caltex) and Ssangyong refineries had increased their stakes to 14.8, 13.2 and 8.5 percent respectively, and the Government's share had dropped slightly to 48.8 percent. Other shareholders have all retained less than 4 percent each.

[8] Primary energy consumption in Korea decreased by 7.4 percent in 1998 (as opposed to increasing by around 10 percent per annum throughout the last decade), petroleum demand was down by 11.1 percent, and oil imports reduced by more than 30 percent (Korea Energy Economics Institute, January 1999). Prior to the crisis, light petroleum product demand was exceeding the forecasts made in the SAR. Even given that demand was detrimentally affected during 1997 (i.e., demand growth was only 3.2 percent as opposed to 10.1 percent in 1996), the actual consumption was 938,000 bpd, compared with the projected figure of 843,000 bpd in the SAR. However, in 1998, demand plummeted to 714,000 bpd, whereas the SAR expected 891,000 bpd.

[9] In October 1998, the Government decided to fully deregulate the Korean refining industry, accelerating this decision from the original January 1999 deadline in order to attract badly needed foreign investment. Foreign backing has proved critical in maintaining cash flows and preserving the creditworthiness of the industry. Several corporate consolidations and sell-offs have occurred as a result. For instance, Hanwha's refinery at Inchon was taken over by Hyundai Oil Refinery Company in September 1998, and Ssangyong Group is negotiating with various foreign companies to reduce its stake in the Ssangyong Oil Refinery, which would reduce its debt-to-equity ratio from 399 percent to 150 percent.

modes), due to the difficulty that the refineries face in divesting their coastal vessels, tanker trucks and rail cars. Therefore, the crisis has reduced not only the overall magnitude of light petroleum products transported within Korea, but also the market share that is transported by pipeline.

19. A quite different impact of the regional crisis has been to provide a major impetus to public sector reform in Korea (para. 21). This has led to plans for restructuring the energy sector and could accelerate reforms relating to energy product pricing (para. 16) and the more efficient transformation, transportation and utilization of energy.

20. **Physical Implementation Delays.** Implementation delays, caused primarily by the problems experienced in obtaining land and right-of-way (para. 9),[10] had two key impacts on the Project. Firstly, delays detrimentally impacted the revenue stream associated with pipeline operation and consequently reduced the recalculated IRR (para. 12).[11] Secondly, the delays meant that final commissioning occurred at about the same time as the onset of the crisis, which may have affected the ability of the refineries to switch modes of transportation (para. 18) even had they been willing. Had full commissioning occurred prior to the crisis then it may have been difficult to switch back to any of the alternative transportation modes.

21. **Reorganization of MOCIE and the Sector.** During the course of Project, MOCIE was reorganized and restructured a number of times, and this detrimentally affected the progress and output of the Energy Conservation Study. The frequent changes of staff responsible for overseeing the Study delayed its completion significantly (para. 15), and did not ensure a consistent commitment to addressing some key issues, most notably the pricing of energy products.[12] This made it difficult for agreement to be reached between the Bank, MOCIE and DOPCO on a suitable TOR for Phase II of the Study. Further, the reorganization of MOCIE, as well as other sector entities, is ongoing, because the regional crisis has provided a major impetus to public sector reform in Korea. The Government intends restructuring the power and gas sectors in parallel, and part of this process would most likely involve the separation out of policy functions vested within the energy sector corporations. Such policy functions would include many energy conservation activities, but no decision has yet been made on how such activities would be consolidated with similar functions currently vested within MOCIE and other Government entities. Therefore, it is likely that the current state of flux within the sector would have precluded immediate adoption of many of the recommendations outlined in the Energy Conservation Study, even had such recommendations been more targeted.

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[10] The original project completion schedule provided by DOPCO can be considered optimistic. For instance, once the land acquisition problem was resolved for the South Seoul Terminal, the network took another two years to complete, which was longer than the remaining time originally estimated for project completion.

[11] Completion delay can be considered to have taken up to two percentage points off the economic IRR.

[12] For example, the Consultant indicated that MOCIE opposed their recommendation to include any evaluation of market-based pricing policies in the Phase I action plan.

D. PROJECT SUSTAINABILITY

22. Overall, project sustainability is rated as likely. Although the sectoral objective relating to the development of an energy conservation strategy, within the framework of a sound pricing policy for energy products (para. 14), has not been achieved, the prospects for the development of such a strategy in future are considered to be likely.[13] The implementation of any future energy conservation measures and reforms of the energy product pricing structure will to a large extent be dependent on the sector structure resulting from current reform initiatives (para. 21). However, the Bank's preliminary review of the Government's restructuring plans, particularly with respect to the power sector, indicates that the reform framework is sound, well-developed and ambitious.

23. With respect to the sustainability of the project objective to enhance the efficiency and reliability of the petroleum supply and distribution system, with resultant economic, environmental and safety benefits, this depends on the future capacity utilization of DOPCO's pipeline system. Although the present level of pipeline utilization is clearly unsustainable, it is projected that, in the medium to longer term, the throughput of petroleum products in the system will rise to the levels expected at appraisal. Hence, the long term sustainability of the pipeline system is considered to be likely.

24. In providing this rating, it is considered that the future utilization of the pipeline will be influenced by: (i) the speed of Korea's recovery from the regional crisis, since this will impact the future demand for light petroleum products; and (ii) the factors influencing the refineries to utilize the pipeline as opposed to alternative transport modes. With respect to the first issue, current projections suggest that the growth rate of petroleum product demand in Korea will soon return to pre-crisis levels. On the second issue, notwithstanding DOPCO's significant financial problems and the unsatisfactory economic IRR of the Project itself (para. 12), the underlying economics of pipeline utilization versus alternative transportation modes has not changed significantly since appraisal. Therefore, apart from the substantial environmental and safety benefits that would accrue from increased transportation of petroleum products by pipeline, the Government still has a clear economic motivation for encouraging greater utilization of DOPCO's pipeline system (which is now a sunk investment), and facilitating a resolution of DOPCO's financial difficulties. Once the impact of the crisis on the cash position of the refineries has subsided, it is considered likely that all parties will reach an agreement on a greater level of pipeline utilization, particularly because the refineries are not only users of the pipeline, but are co-owners of DOPCO along with the Government.

E. BANK PERFORMANCE

25. **Identification and Preparation**. Bank performance in identifying and preparing the Project was satisfactory. Project design was consistent with the Bank's country assistance strategy, including the requirement to include a substantial value-added component (para. 6), and with the country's development priorities (para. 1).

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[13] Although the Bank cannot take the credit for this possible future outcome through implementation of the Project, the Bank did manage to keep the issue of energy product pricing firmly within the agenda for sectoral dialogue with the Government (para. 28).

26. **Appraisal**. Bank performance in appraising the Project was satisfactory. The problems that later beset the Project were not foreseeable, hence the rating for project risks in the SAR as minimal is understandable. In particular, the sustainability of pipeline operation and DOPCO's future financial position looked secure,[14] since the Korean Regulation for Oil Transportation (1993) required any user of DOPCO's pipeline network to enter into a take-or-pay agreement with DOPCO. The Bank provided inputs into the technical aspects of the Project, reviewed the proposed pipeline tariff structure, and assessed the impact of possible implementation delays and cost over-runs on the Project's IRRs.

27. Bank involvement had a noteworthy value-added impact on the Project during appraisal with respect to environmental and safety issues, although this impact was not considered to be of sufficient significance to warrant a specific objective in the project design.[15] This impact included: (i) raising DOPCO's awareness to the preservation of natural resources, leading to the development of spill control plans and teams; (ii) drawing attention to the high risk potential in the terminals and pipelines, leading to the development of disaster contingency plans and emergency teams, and requiring DOPCO to commission an independent risk analysis study to assess insurance liability; (iii) improving DOPCO's capability to prepare environmental and hazard assessment reports; and (iv) drawing attention to the high traffic load around the South Seoul Terminal, resulting in design changes to cope with the large number of trucks/people in and around the terminal.

28. **Supervision**. Bank supervision was satisfactory, although it was light in terms of the numbers of staff associated with supervision missions because very little resources were provided for supervision of projects in Korea. It is difficult, however, to see how additional resources would have had much impact on two of the main factors influencing project outcome, either (a) the problems experienced between DOPCO and the refineries (para. 17), since this issue was primarily caused by the regional crisis and its resolution will require the direct intermediation of the Government, or (b) the delays experienced in acquiring land (para. 20), since this again required Government intervention. Nevertheless, the Bank did take strong measures with respect to the progress of the Energy Conservation Study. The Bank provided a number of TORs for Phase II of the Study in an attempt to elicit action. Through numerous strongly-worded communications with DOPCO and MOCIE, the Bank made it clear that successful completion of the Study was critical to a satisfactory outcome for the Project as a whole, and the Bank also ensured that the key issue of energy product pricing remained firmly within the Study's scope of work. In addition, the Bank attempted to apply direct leverage by indicating that DOPCO's request to utilize part of the Loan to cover a number of self-financed project components, would not be considered until after work on the Phase II Study had begun.[16] Finally, in an attempt to ensure that output of the Phase II Study was of sufficient quality, the Bank required the invitations to consultants to be reissued, since only one proposal had been received the first time (para. 15).

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[14] In fact, the Project's finances looked so strong that one peer reviewer questioned the need for the proposed financial covenants, and for a 15 year loan maturity.

[15] The specific environmental and safety objectives incorporated into project design related to outcomes that were implicit to the development of the pipeline network, irrespective of Bank involvement.

[16] The Bank also provided an incentive to DOPCO to facilitate action on the Study by including in the final TOR a section comprising a management program and strategic plan for DOPCO (para. 15). This section of the Phase II report proved to be useful to DOPCO in developing an action plan to address its current problems (para. 32).

F. BORROWER PERFORMANCE

29. **Preparation and Implementation.** DOPCO's performance during preparation and implementation of the project was satisfactory. DOPCO took into account the Bank's recommendations relating to project design, particularly with respect to environmental and safety aspects. Subsequent factors that detrimentally affected project outcome (paras 17-18, and 20), which resulted in physical implementation delays and caused DOPCO to be in default of the Bank's debt service ratio covenant, were primarily outside of DOPCO's control. Further, with respect to the progress and quality of the Energy Conservation Study, DOPCO staff were not in a position either to scope the study or to closely monitor the Consultant, and were therefore dependent on cooperation from MOCIE. MOCIE's commitment to the Study in general, and to addressing the more sensitive issues such as pricing, was not consistent during the course of the Project (para. 21). However, commitment to expediting the completion of the Study improved markedly during the last 18 months of project implementation as a result of the Ministry's most recent reorganization.

G. ASSESSMENT OF OUTCOME

30. The overall outcome of the Project is unsatisfactory. The low utilization of the pipeline network has resulted in a less than satisfactory IRR for the Project (para. 12), and lower than expected environmental benefits. Nevertheless, this result might potentially have been counterbalanced by the satisfactory achievement of the key value-added component of the Project relating to energy conservation, since the inclusion of such a component in the project design was the key justification for the Loan to have been processed. Unfortunately, given the SAR's focus on action and on the actual implementation of an energy conservation program, within the framework of a sound pricing policy for energy products, the Project cannot be considered to have achieved the intended sectoral development impact, even when it is acknowledged that the detailed aims and scope of this component became less ambitious between identification and appraisal (para. 7).

31. Nevertheless, this result must be qualified by the following considerations. Firstly, the development of a nationwide petroleum distribution network is of strategic significance; it is a long-lived infrastructure asset that will most likely have a positive and sustainable development impact in the long term (para. 23). The recognition of the network's long term value is evidenced by the Government's current attempts to broker a satisfactory agreement between DOPCO and the refineries (para. 33). Secondly, although the value-added component associated with Bank involvement ended up being modest, positive impacts were achieved with respect to the environmental and safety aspects of the Project (para. 27). Thirdly, now that the financial crisis appears to have convinced the Government of the need for speedy reforms and reform initiatives are afoot, the energy conservation and product pricing study is expected to provide guidance and input into the sectoral reform process, even if belatedly.

H. FUTURE OPERATION

32. DOPCO's action plan to address its current difficulties, in order to ensure the future sustainability of its operation, comprises: (i) increasing sales volume, as a result of joint negotiations between DOPCO, the Government (as majority shareholder) and the refineries (being both users and minority shareholders); (ii) improving the Corporation's financial structure,

by seeking debt/equity conversion and temporary debt forgiveness from the Government, and also by extending the pipeline depreciation period to be more than the current 20 years; and (iii) making the Corporation's management system more efficient, through restructuring and downsizing.

33. MOCIE is coordinating the ongoing negotiations between DOPCO and the refineries, since the Government has a strong motivation to increase capacity utilization of the pipeline network in the national interest, for environmental and economic reasons (para. 24).[17] Preliminary indications are that the refineries will agree to a three year transition period during which utilization of the pipeline will be gradually increased. DOPCO has agreed to keep the Bank informed of the outcome of these ongoing discussions, and to continue to provide the Bank with both its audited and unaudited financial statements upon request. These can be used as measures of the ongoing sustainability of the project, since they reflect DOPCO's market share, revenue and cost effectiveness.

I. KEY LESSONS LEARNED

34. The experience gained in this Project re-emphasizes the importance of having a consistent Government commitment to addressing sensitive sector issues, and highlights the susceptibility of initial support, which was forthcoming during appraisal, to subsequent changes in key personnel. Although potentially the Bank's involvement could have added significant value to the design of Korea's energy conservation program (para. 7), in the absence of MOCIE's consistent commitment to the Energy Conservation Study, the Loan was structured in such a way as to provide little incentive to MOCIE to facilitate progress on the Energy Conservation Study, the Project's key value-added component. DOPCO was the implementing agency for the Study but did not have the capability to oversee it. Hence, it was difficult for DOPCO to understand the Bank's attempt to compel action on the Study by withholding agreement on utilizing part of the Loan for components which DOPCO had self-financed (para. 28). On the other hand, directly loaning the funds for the Study to MOCIE might not have improved the situation unless MOCIE's commitment was already secure. One possible approach might have been to provide an additional component of the Project to MOCIE that could potentially have been used as an incentive to make progress on the Study (e.g., training for MOCIE staff).

35. The poor rate of return achieved by the pipeline network indicates that the success of even the most apparently financially-viable project (para. 26) can be partly undermined by unforeseen exogenous factors, in this case the regional crisis (and, to some extent, the currently low price of oil). One possible approach to internalizing these factors within the Project could have been to require that the take-or-pay agreements between DOPCO and the refineries specifically specified satisfactory transportation quantities. Nevertheless, without direct Government intervention to enforce these agreements, the refineries would still have been in a position to alter their strategies in the face of changing external circumstances.

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[17] Another reason that the Government has to increase pipeline utilization is to improve DOPCO's financial position, in order to receive reasonable proceeds from DOPCO's planned privatization. However, improving DOPCO's financial position sufficiently for privatization to proceed may be at odds with increasing pipeline utilization.

IMPLEMENTATION COMPLETION REPORT
KOREA
PETROLEUM DISTRIBUTION AND SECTOR MANAGEMENT IMPROVEMENT PROJECT
(Loan 3613-KO)

PART II: STATISTICAL ANNEXES

Table 1: Summary of Assessment

A. Achievement of objectives	Substantial	Partial	Negligible	Not applicable
	(/)	(/)	(/)	(/)
Sector policies	☐	☒	☐	☐
Physical objectives	☒	☐	☐	☐
Environmental objectives	☐	☒	☐	☐
Economic benefits	☐	☒	☐	☐
Financial objectives	☐	☐	☒	☐
Institutional development	☒	☐	☐	☐
Macroeconomic policies	☐	☐	☐	☒
Poverty reduction	☐	☐	☐	☒
Gender concerns	☐	☐	☐	☒
Other social objectives	☐	☐	☐	☒
Public sector management	☐	☐	☐	☒
Private sector development	☐	☐	☐	☒

B. Project Sustainability	Likely	Unlikely	Uncertain
	(/)	(/)	(/)
	☒	☐	☐

C. Bank Performance	Highly Satisfactory	Satisfactory	Deficient
	(/)	(/)	(/)
Identification	☐	☒	☐
Preparation assistance	☐	☒	☐
Appraisal	☐	☒	☐
Supervision	☐	☒	☐

D. Borrower Performance	Highly Satisfactory	Satisfactory	Deficient
	(/)	(/)	(/)
Preparation	☐	☒	☐
Implementation	☐	☒	☐
Covenant compliance	☐	☐	☒

E. Assessment of Outcome	Highly Satisfactory	Satisfactory	Unsatisfactory	Highly Unsatisfactory
	(/)	(/)	(/)	
Assessment of outcome	☐	☐	☒	☐

Table 2: Related Bank Loans

Loan/credit title	Purpose	Year of approval	Status
Energy Second Power Project (Loan 2671-KO)	Support the Korea Electric Power Corporation's (KEPCO) 1986-89 investment program of constructing additional transmission and distribution facilities to match its generation expansion program and meet the demand growth reliably and efficiently.	1986	Closed
Gas Utilization Study (Report No. 8142-KO)	Objectives were to (i) establish the scope for the economic use of gas in Korea; (ii) assess the viability of alternative investment scenarios in gas infrastructure to meet projected demand; (iii) outline the possible role of natural gas in reducing air pollution in Korea; and (iv) review the adequacy of the sector's institutional and policy framework in meeting Government objectives.	1990	Closed
Gas System Expansion Project (Loan 3413-KO)	Objectives were: (i) provision of the additional infrastructure required to facilitate the import and utilization of 5 mty of LNG by 1995, thereby improving the efficiency of energy use in Korea and mitigating its impact on air quality in urban areas; and (ii) strengthening KGC's operational performance and management, particularly in the area of financial management.	1997	Closed

Table 3: Project Timetable

Steps in project cycle	Date planned	Date actual
Identification	N/A	September 1991
Preparation	N/A	December 1991
Appraisal	June 1992	July 1992
Negotiations	November 1992	April 1993
Board presentation	January 1993	May 12, 1993
Signing	N/A	June 30, 1993
Effectiveness	N/A	September 13, 1993
Project completion	December 31, 1995	March 31, 1999
Loan closing	June 30, 1996	December 31, 1998

Table 4: Loan Disbursements - Cumulative Estimated and Actual (US$ million)

Bank FY	FY94	FY95	FY96	FY97*	FY98	FY99
Appraisal estimate	64.3	107.5	120.0			
Revised estimates (at first extension)	37.0	70.0	79.0	110.0	120.0	-
Actual	37.9	68.4	75.7	94.8	100.2	115.2
Actual as % of revised estimate	102%	98%	96%	86%	84%	96%

Table 5: Key Indicators for Project Implementation
Implementation Progress

Activity	Starting	Completion		
	Planned Date	Planned Date	Actual Date	Remarks
1). Investigation and Design				
• **basic design**	Dec 1990	Jun 1991	Jun 1991	
• **detailed design**	Jul 1991	Jan 1992	Jan 1992	
2). Supervision	Aug 1991	Jun 1995	Oct 1997	
3). Land Purchase/Rent/Compensation	Mar 1991	Jun 1994	Dec 1995	Delays experienced acquiring land for the South Seoul Terminal
4). Construction Work				
• **pipeline**	Oct 1991	Jun 1995	Oct 1996	
• **terminals**	Feb 1992	Jun 1995	Jun 1997	
• **pump stations**	Mar 1992	Jun 1995	Mar 1995	
• **equipment and materials procurement**	Aug 1991	Jun 1994	Oct 1997	
5). Startup and Test	Jan 1995	Jun 1995	Oct 1997	
6). Construction Management	Jul 1990	Jun 1995	Oct 1997	
7). Energy Conservation Study				Delays experienced
• **Phase I**	Dec 1992	Mar 1993	Apr 1993	finalizing TOR and
• **Phase II**	Jul 1994	Jul 1995	Mar 1999	awarding consultancy contract for Phase II

Table 6A: Key Performance Indicators for Project Operation – DOPCO's Income Statement
(Million Won)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Revenues from Sales	3,608	5,368	9,380	18,963	33,560	40,570	52,525	72,847	96,159	102,809	106,829
Operating Expenses											
electricity	402	521	1,215	2,130	3,268	2,981	3,728	4,735	6,250	6,682	6,944
labor	3,363	3,787	5,864	7,817	8,969	11,490	10,176	10,481	10,795	11,118	11,451
O&M	128	165	147	351	810	708	8,612	8,870	9,136	9,410	9,692
admin	2,602	3,336	5,315	8,030	9,409	14,062	3,645	3,754	3,866	3,982	4,101
depreciation	2,140	2,308	10,098	19,823	24,302	16,836	20,215	20,542	20,542	20,542	20,542
Total Operating Expenses	8,635	10,117	22,639	38,151	46,758	46,077	46,376	48,382	50,589	51,734	52,730
Operating Income	(5,027)	(4,749)	(13,259)	(19,188)	(13,198)	(5,507)	6,149	24,465	45,570	51,075	54,099
Non-Operating Income	9,250	8,892	11,276	16,482	16,385	31,192	2,992	-	-	-	-
Interest	2,076	2,211	10,291	27,953	42,223	58,718	50,121	50,125	46,687	43,414	42,055
Income before Taxes	(537)	(1,300)	(16,219)	(41,335)	(44,325)	(35,650)	(40,980)	(25,660)	(1,117)	7,661	12,044
Taxes	531	237	-	-	-	-	-	-	-	-	-
NET INCOME	(1,068)	(1,537)	(1,537)	(41,335)	(44,325)	(35,650)	(40,980)	(25,660)	(1,117)	7,661	12,044

Note: Revenue includes Korea Oil Pipeline Company which was acquired by DOPCO in July 1998

Table 6B: Key Performance Indicators for Project Operation – DOPCO's Balance Sheet
(Million Won)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
ASSETS											
Current Assets											
cash	66,309	71,919	117,441	135,053	80,138	30,128	73,553	21,001	21,810	16,364	17,709
accounts receivable	918	769	3,463	4,272	7,246	5,669	5,251	6,236	6,860	7,546	8,300
inventories and stocks	559	342	328	1,668	1,898	3,168	1,628	1,415	1,415	1,416	1,415
other current assets	12,312	11,672	11,463	12,865	5,368	3,537	3,672	3,842	3,923	3,989	4,012
Total Current Assets	80,098	84,702	132,695	153,858	94,650	42,502	84,104	32,494	34,008	29,315	31,436
Fixed Assets											
gross fixed assets	72,519	94,082	395,087	433,261	637,889	822,039	822,039	874,667	874,667	874,667	874,667
less: accum depreciatn	2,415	4,661	14,710	34,921	59,107	28,631	48,846	69,388	89,930	110,472	131,614
Net Fixed Assets	70,104	89,421	380,377	398,340	578,782	793,408	773,193	805,279	784,737	764,195	743,653
Work in Progress	184,322	331,071	123,389	151,297	10,902	22,651	52,628	-	-	-	
Other Assets	1,272	11,548	11,658	17,405	26,687	21,486	21,420	5,210	5,210	5,210	5,210
Deferred Charges	5,019	2,772	326	152	42,292	35	315	420	362	298	210
TOTAL ASSETS	343,230	524,175	663,155	755,973	812,420	908,713	931,660	843,403	824,317	799,018	780,509
LIABILITIES											
Current Liabilities											
accounts payable	3,096	25,186	3,586	7,088	2,304	4,623	1,200	800	800	800	800
short term borrowing	-	-	-	-	-	-	-	-	-	-	-
other	738	2,082	22,599	12,483	5,738	10,437	5,124	4,923	4,872	4,562	4,425
current portion of LTD	-	2,772	4,255	9,455	22,433	33,578	132,312	118,312	72,783	50,575	95,097
Total Current Liabilities	3,834	30,040	30,440	29,026	30,475	48,638	138,636	124,035	78,455	55,937	100,322
Long Term Debt											
gross long term debt	155,454	266,812	420,092	555,446	652,100	630,100	691,432	579,120	560,808	528,025	497,450
less: current portion	-	-	-	-	-	-	132,312	118,312	72,783	50,575	95,097
Net Long Term Debt	155,454	266,812	420,092	555,446	652,100	630,100	559,120	460,808	488,025	477,450	402,353
Other Liabilities	1,192	1,819	3,225	3,894	6,563	5,920	829	1,145	1,539	1,672	1,831
TOTAL LIABILITIES	160,480	298,671	453,757	588,366	689,138	684,658	698,585	585,988	568,019	535,059	504,506
EQUITY											
Capital Stock	169,950	214,081	214,081	214,081	214,081	224,956	274,956	324,956	324,956	324,956	324,956
Revaluation Reserve	-	-	-	-	-	-	-	-	-	-	-
Retained Earnings	12,800	11,423	(4,683)	(46,474)	(90,799)	(901)	(41,881)	(67,541)	(68,658)	(60,997)	(48,953)
TOTAL EQUITY	182,750	225,504	209,398	167,607	123,282	224,055	233,075	257,415	256,298	263,959	276,003
TOTAL LIABILITIES AND EQUITY	343,230	524,175	663,155	755,973	812,420	908,713	931,660	843,403	824,317	799,018	780,509

Table 7: Studies Included in Project

Technical Assistance	Purpose as defined at pre-appraisal/appraisal	Status	Impact of study
Energy Conservation Study – Phase I	The objective was to: (i) characterize energy use in Korea: (ii) review existing conservation efforts and analyze the reasons for the slowdown of existing efforts; (iii) broadly identify areas which would lead to a reduction in energy demand with an estimate of potential savings for each; and (iv) to develop prioritized conservation programs including TORs for their implementation in Phase II.	Completed April 1993	The Phase I Report focused on outlining an action plan involving the development of planning and monitoring systems. The report lacked a consistent set of conservation potential estimates which could be used to identify specific program opportunities or targets, and the material on institutions and pricing was highly theoretical.
Energy Conservation Study – Phase II	The objective was to extend the action plan presented in Phase I by identifying: (i) more in-depth policy and program actions; (ii) required changes to policy, institutional roles and implementation mechanisms; and (iii) necessary monitoring, evaluation and compliance mechanisms.	Completed March 1999	The final TOR for Phase II, agreed upon between the Bank, MOCIE and the Consultant, comprised the following tasks: (i) an evaluation of energy pricing in Korea; (ii) the development of a methodology for energy conservation evaluation; (iii) the preparation and execution of an intensive energy conservation training workshop for MOCIE staff; (iv) the development of an effective demand side management (DSM) approach for Korea's transportation sector; (v) an evaluation of energy conservation programs; and (vi) the development of a management program and strategic plan for DOPCO. MOCIE have indicated that in the final Phase II report: (i) the analysis model and discussion on energy pricing will help MOCIE's establishment of energy pricing policy in the near future; (ii) Korea-specific, usable methodologies for energy conservation analysis, and procedures for their planning, implementation and evaluation are presented; and (iii) foreign experiences with DSM in the transportation sector are used as good case studies for the introduction of Korea's own policy. However, the institutional environment relating to the energy sector is changing rapidly, precluding the immediate adoption of any action plan concerning energy conservation measures.

Table 8A: Project Costs
(US$ million)

GOODS AND WORKS	Appraisal Estimate 1/			Latest Estimate 2/		
	Local	Foreign	Total	Local	Foreign	Total
Land and ROW	111.0	-	111.0	58.5	-	58.5
Materials	79.0	41.0	120.0	62.4	45.3	107.7
Pipeline Construction	185.7	-	185.7	134.5	3.1	137.3
Terminal/Pump Construction and SCADA	76.2	40.5	116.7	104.7	25.8	130.5
Start Up	2.2	-	2.2	1.8	-	1.8
Design/Engineering Services	41.7	-	41.7	30.4	-	30.4
Incheon-Seoul and Yeongjongdo Segment	81.0	-	81.0	49.2	1.9	51.1
Studies/TA	-	3.5	3.5	-	3.2	3.2
Administrative				121.7	14.1	135.8
Contingencies	39.5	14.8	54.3	-	-	-
TOTAL COST (excluding IDC)	619.5	134.8	754.2	-	-	-
TOTAL COST (including IDC)	**672.4**	**137.3**	**809.7**	**563.0**	**90.0**	**653.0**

1/ Exchange rate from SAR (as of December 1992): US$1 = KRW 780
2/ Exchange rate (as of December 31, 1998): US$1 = KRW 1,209.5

Table 8B: Project Financing
(US$ million)

Source	Appraisal Estimate			Latest Estimate		
	Local	Foreign	Total	Local	Foreign	Total
Equity	228.7	-	228.7	225.0	-	225.0
IBRD	-	120.0	120.0	-	115.2	115.2
Commercial Borrowings	443.7	17.3	461.0	312.8	-	312.8
TOTAL	**672.4**	**137.3**	**809.7**	**537.8**	**115.2**	**653.0**

Table 9A: Economic and Financial Costs and Benefits
Light Oil Petroleum Products – Total Demand, Volume Transported by DOPCO Project, and Displaced Volumes/Costs of Alternative Transportation Modes

	Total Light Oil Petroleum Product Demand (bpd)	Volume Transported by DOPCO Pipeline Project (bpd)	Coastal Vessels Transport Volume Displaced by Pipeline (bpd)	Rail Tankers Transport Volume Displaced by Pipeline (bpd)	Road Trucks Transport Volume Displaced by Pipeline (bpd)	Displaced Cost of Coastal Vessels (Mil US$/yr)	Displaced Cost of Rail Tankers (Mil US$/yr)	Displaced Cost of Road Trucks (Mil US$/yr)	Total Displaced Cost of Alternative Transportation Modes (Mil US$/yr)
1993	648,000	51,300	33,632	8,264	9,403	5.82	2.03	2.23	10.09
1994	714,000	83,000	54,415	13,371	15,214	9.42	3.29	3.61	16.32
1995	826,000	106,400	69,756	17,141	19,503	12.07	4.22	4.63	20.92
1996	909,000	157,500	103,257	25,373	28,870	17.87	6.24	6.85	30.97
1997	938,000	219,000	143,576	35,281	40,143	24.87	8.68	9.53	43.06
1998	714,000	218,300	143,117	35,168	40,014	24.77	8.65	9.50	42.93
1999	810,000	240,300	157,541	38,712	44,047	27.27	9.53	10.46	47.25
2000	874,000	300,000	196,680	48,330	54,990	34.04	11.89	13.06	58.99
2001	919,000	395,800	259,486	63,763	72,550	44.91	15.69	17.22	77.83
2002	975,000	424,500	278,302	68,387	77,811	48.17	16.83	18.47	83.47
2003	1,009,000	445,100	291,808	71,706	81,587	50.51	17.65	19.37	87.52
2004	1,039,000	465,800	305,378	75,040	85,381	52.86	18.47	20.27	91.59
2005	1,070,000	487,000	319,277	78,456	89,267	55.26	19.31	21.19	95.76
2006	1,102,000	510,700	334,815	82,274	93,611	57.95	20.25	22.22	100.42
2007	1,135,000	535,700	351,205	86,301	98,194	60.79	21.24	23.31	105.34
2008	1,169,000	562,800	368,972	90,667	103,161	63.86	22.31	24.49	110.67
2009	1,204,000	590,800	387,328	95,178	108,294	67.04	23.42	25.71	116.17
2010	1,240,000	621,100	407,193	100,059	113,848	70.48	24.62	27.03	122.13
2011	1,278,000	645,000	422,862	103,910	118,229	73.19	25.57	28.07	126.83
2012	1,316,000	670,100	439,318	107,953	122,829	76.04	26.56	29.16	131.76
2013	1,355,000	696,500	455,970	112,045	127,485	78.92	27.57	30.27	136.76
2014	1,396,000	721,700	473,147	116,266	132,288	81.89	28.61	31.41	141.91

Table 9B: Economic and Financial Costs and Benefits
Economic Rate of Return

	Pipeline Investment Cost (Mil US$)	Pipeline Operating Cost (Mil US$)	Benefits from Displaced Cost of Alternative Transportation Modes (Mil US$)	Net Benefits (Mil US$)
1990	(8.36)			(8.36)
1991	(32.07)			(32.07)
1992	(85.95)			(85.95)
1993	(95.96)	(3.11)	10.09	(88.99)
1994	(137.71)	(3.57)	16.32	(124.96)
1995	(84.48)	(5.77)	20.92	(69.33)
1996	(85.21)	(8.23)	30.97	(62.46)
1997	(79.40)	(10.42)	43.06	(46.80)
1998	(21.30)	(12.13)	42.93	9.50
1999		(17.99)	47.25	29.26
2000		(19.24)	58.99	39.75
2001		(20.91)	77.83	56.91
2002		(21.74)	83.47	61.73
2003		(22.44)	87.52	65.08
2004		(23.11)	91.59	68.48
2005		(23.80)	95.76	71.96
2006		(24.52)	100.42	75.90
2007		(25.25)	105.34	80.09
2008		(26.01)	110.67	84.66
2009		(26.79)	116.17	89.38
2010		(27.59)	122.13	94.54
2011		(28.42)	126.83	98.41
2012		(29.27)	131.76	102.49
2013		(30.15)	136.76	106.61
2014		(31.05)	141.91	110.86
			EIRR	**6.80%**

Table 9C: Economic and Financial Costs and Benefits
Financial Rate of Return

	Pipeline Investment Cost	Pipeline Operating Cost	Volume Transported by DOPCO Pipeline Project (bpd)	Average Transportation Distance	Pipeline Transport Revenue	Volume Stored by DOPCO Pipeline Project	Storage Revenue	Total Revenue	Net Benefits
	(Mil US$)	(Mil US$)		(km/day)	(Mil Won)	(bpd)	(Mil Won)	(Mil US$)	(Mil US$)
1990	(8.66)								(8.66)
1991	(33.19)								(33.19)
1992	(88.95)								(88.95)
1993	(99.32)	(3.22)	51,300	28.1	1,688	30,400	1,920	2.98	(99.56)
1994	(142.53)	(3.70)	83,000	27.6	2,674	42,700	2,694	4.44	(141.79)
1995	(87.44)	(5.97)	106,400	53.2	5,989	53,700	3,391	7.76	(85.66)
1996	(88.19)	(8.51)	157,500	90.9	14,581	69,400	4,383	15.68	(81.02)
1997	(82.22)	(10.79)	219,000	147.7	28,193	84,900	5,362	27.74	(65.27)
1998	(22.04)	(12.55)	218,300	206.1	30,764	108,800	7,347	31.51	(3.08)
1999		(18.62)	240,300	208.5	39,564	105,600	7,133	38.61	19.99
2000		(19.91)	300,000	257.3	56,452	144,300	9,883	54.84	34.93
2001		(21.65)	395,800	276.8	75,235	206,800	14,108	73.87	52.22
2002		(22.50)	424,500	276.5	80,381	223,300	15,230	79.05	56.55
2003		(23.22)	445,100	275.3	83,433	234,100	15,962	82.18	58.96
2004		(23.92)	465,800	274.1	86,738	244,400	16,663	85.49	61.57
2005		(24.64)	487,000	273.0	90,144	255,000	17,386	88.90	64.27
2006		(25.37)	510,700	271.3	93,785	266,200	18,150	92.55	67.17
2007		(26.13)	535,700	269.7	97,600	278,000	18,946	96.36	70.22
2008		(26.92)	562,800	267.9	101,635	290,200	19,781	100.39	73.47
2009		(27.73)	590,800	266.2	105,803	302,900	20,644	104.54	76.82
2010		(28.56)	621,100	264.3	110,215	316,300	21,549	108.94	80.38
2011		(29.41)	645,000	263.9	114,156	328,700	22,394	112.90	83.48
2012		(30.30)	670,100	263.4	118,279	341,600	23,273	117.03	86.74
2013		(31.20)	696,500	263.1	122,455	354,800	24,168	121.23	90.02
2014		(32.14)	721,700	262.6	126,755	368,200	25,084	125.54	93.40
								FIRR	**4.34%**

Table 10: Status of Legal Covenants

Agreement	Section	Covenant Type	Present Status	Original Date	Description of Covenant	Comments
Loan	3.01 (a)	6	C		The Borrower to carry out the implementation of the Energy Conservation Action Plan prepared under Phase I of the Energy Conservation Study.	In compliance
	4.01 (a)	1	C		The Borrower to have records and accounts with respect to withdrawals from the Loan Account made on the basis of SOE including those for the Special Account for each fiscal year properly audited and submit the report of such audit to the Bank not later than six months after the end of each such year.	In compliance
Project	2.01	4, 10	C		DOPCO to carry out the Project efficiently and in conformity with appropriate administrative, financial, engineering and public utility practices, and to provide the necessary funds, services and facilities required for the project.	In compliance
	2.02	10	C		Procurement of goods, works and consultants' services required for the Project and financed out of the proceeds of the Loan to be governed by the provisions of Schedule 1.	In compliance
	4.01 (ii)	1	C		Furnish to the Bank, not later than six months after the end of each fiscal year, DOPCO's audited Financial Statements.	In compliance
	4.02 (a)	2	NC		DOPCO shall not incur any debt unless a reasonable revenues and expenditures forecast shows that the estimated net revenues of DOPCO for each fiscal year during the term of the debt to be incurred is at least 1.2 times the estimated debt service requirements of DOPCO in such year on all debt of DOPCO including the debt to be incurred.	Not in compliance
	4.03 (a)	2	NC		DOPCO shall not incur any debt, if after the incurrence of such debt the ratio of debt to equity is greater than 70 to 30.	Not in compliance
	4.04 (a)	2	C		DOPCO shall maintain a ratio of current assets to current liabilities of not less than 1.2	In compliance
	Sch. 2(a)	6, 9	CD	3/31/95	DOPCO to complete Phase II of the Energy Conservation Study.	Completed March 1999
	Sch. 2(b)	5, 9	C	3/31/95	DOPCO to complete a study for the development of a management information system.	In compliance
	Sch. 2(c)	6	C		Implement the mitigation strategies, monitoring and evaluation practices, and safety procedures contained in the Environmental Assessment Report.	In compliance
	Sch. 2(d)	9	C	8/31/93	Prepare a staff training action plan to be implemented over the following two year period for the purposes of strengthening DOPCO's financial, operational and managerial capabilities.	In compliance
	Sch. 2(e)	9	C		DOPCO, commencing fiscal year 1993, and not later than December 31 in each fiscal year thereafter, to carry out, together with the Bank, an annual review of its investment program.	In compliance
	Sch. 2(f)	9	C		DOPCO to submit quarterly progress reports.	In compliance
	Sch. 2(h)	9	C		DOPCO to carry out, with the assistance of insurance consultants, a study on the risks associated with the operation of the pipeline and submit report containing the consultant's findings and recommendations to the Bank.	In compliance

C = Covenant complied with
CD = Complied with after delay
CP = Complied with partially
NC = Not complied with

Covenant type:
1 = Account/Audits
2 = Financial performance/revenue generation from beneficiaries
3 = Flow and utilization of project funds
4 = Counterpart funding
5 = Management aspects of project or executing agency
6 = Environmental covenants
7 = Involuntary resettlement
8 = Indigenous people
9 = Monitoring, review, and reporting
10 = Project implementation not covered by categories 1-9
11 = Sectoral or cross-sectoral budgetary or other resource allocation
12 = Sectoral or cross-sectoral policy/regulatory/institutional action
13 = Other

Table 11: Compliance with Operation Manual Statements

Statement number and title	Description and comment on lack of compliance
None	No significant lack of compliance with applicable Bank manual statements observed

Table 12: Bank Resources - Staff Inputs (as of March 1999)

Stages of project cycle	Staffweek Actual	Amount US$('000)
Pre-Appraisal	32.3	109.6
Appraisal	21.3	71.5
Negotiation	9.6	29.7
Supervision	36	125.8
Completion	7.8	41.6
TOTAL	107.0	378.2

Table 13: Bank Resources - Missions

Stages of Project cycle	Month/ Year	No. of Persons	SW in Field:	Specialized Staff skills Represented	Performance rating Implement. Progress	Performance rating Developt. Objectives	Types of Problems
Supervision I	3/94	1	1	ES	U	S	Land acquisition problems responsible for implementation delays
Supervision II	9/94	1	1	ES	U	S	Implementation delays, and failure to begin Energy Conservation Study Phase II
Supervision III	1/95	1	1	ES	U	S	Land acquisition problems resolved, TOR for Energy Conservation Study provided to DOPCO
Supervision IV	8/95	1	1	ES	S	S	Finalization of TOR for Energy Conservation Study delayed due to reorganization of MOCIE
Supervision V	2/97	1	1	ES	S	S	TOR finalized, but only one proposal submitted in response to invitation to bid
Supervision VI	12/97	2	2	ES, OO	S	S	Physical works completed
Limited Supervision I	3/98	1	0.2	ES, EC	S	S	Kickoff meeting for Energy Conservation Study
Supervision VII	5/98	2	2	ES, EC	S	S	Review of progress on Energy Conservation Study
Limited Supervision II	10/98	1	0.2	EC	S	S	Meeting between the Bank, MOCIE and Consultant to review progress on Energy Conservation Study
ICR	1/99	2	2	ES, EC	S	S	ICR mission

ES - Energy Specialist; EC - Energy Consultant; OO - Operations Officer

APPENDICES

KOREA
PETROLEUM DISTRIBUTION AND SECTOR MANAGEMENT IMPROVEMENT PROJECT
(LOAN NO. 3613-KO)

AIDE MEMOIRE – FEBRUARY 1999

1. A World Bank mission comprising Messrs Farhandi and Gunn (EASEG) visited Korea from February 7-13, 1999, to begin preparation of the Implementation Completion Report (ICR) for the Petroleum Distribution and Sector Management Improvement Project (Loan No. 3613-KO). The Borrower for the Project is the Daehan Oil Pipeline Corporation (DOPCO) and the loan amount was US$120 million equivalent. The original loan closing date was June 30, 1996, but there have been two extensions, and the final revised closing date was December 31, 1998. During the course of the mission, the team met with representatives from: DOPCO's Planning and Coordination, Marketing, Financial Managing, and International Business Development Departments; the Korea Energy Economics Institute (KEEI); and the Energy Conservation Policy Division of the Ministry of Commerce, Industry and Energy (MOCIE).

2. The mission team explained to DOPCO that the ICR process is designed to improve the quality and effectiveness of the Bank's lending by: (i) providing feedback from implementation experience to improve future lending strategies and design of future operations; (ii) helping to ensure greater development impact and sustainability of the project during the operation phase; (iii) reinforcing self-evaluation, including development impact assessment, by the Bank, the Borrower and the Government; (iv) meeting the accountability and transparency in the Bank's activities; and (v) maintaining a record of the implementation experience of the Bank financed operations to facilitate assessment of the development impact.

3. The mission team also indicated that DOPCO should also prepare a summary of the findings of its own evaluation of the project, in less than ten pages, and requested that this be submitted to the Bank by March 15, 1999. The team outlined to DOPCO that the evaluation summary should include: (i) an assessment of the project objectives, design, implementation, and operations experience; (ii) an evaluation of DOPCO's own performance during the evolution and implementation of the project, with specific emphasis on lessons learned that may be relevant in the future; and (iii) an evaluation of the performance of the Bank during the evolution and implementation of the project, including the effectiveness of the relationship between DOPCO and the Bank, again with special emphasis on the lessons learned.

4. The mission focused on four main areas: (i) informing DOPCO of the data and information that the Bank requires to prepare the ICR, and collecting such material where immediately available; (ii) providing a preliminary review of Project implementation and the achievement of Project objectives; (iii) providing a preliminary review of Project sustainability; and (iv) agreeing with DOPCO on an operational plan for the Project.

Data and Information Requirements

5. The mission requested material from DOPCO in order to update the tables in the Staff Appraisal Report (SAR) for incorporation into the ICR, including: (i) implementation progress, and procurement and disbursement status over the Project period; (ii) total project cost breakdowns; (iii) data to recalculate the Project's economic and financial internal rates of return; (iv) DOPCO's actual and projected financial status; and (v) DOPCO's tariff schedules for transportation and storage of petroleum products. DOPCO

provided the majority of this material, but since much of it was in Korean, the mission requested that DOPCO provide translated versions of the required material by March 1, 1999.

Project Objectives and Implementation

6. **Physical Progress**. The main objective of the project was to establish a more efficient and reliable petroleum supply and distribution system in Korea through the construction of pipeline network, and as a result to improve environmental quality and safety levels by reducing air and water pollution and by reducing rail and road hazards. This pipeline network was successfully completed in late 1997. However, the loan had to be extended from the original closing date of June 1996 by 18 months, because of slippage in the completion schedule due to difficulties encountered in purchasing land for the pumping station near Seoul. (The loan was further extended by an additional 12 months to December 1998 to accommodate the completion of the Energy Conservation Study, para. 7) Nevertheless, the mission team explained to DOPCO that, as part of the ICR process, the successful completion of the Project's physical components needs to be evaluated in the context of the Project's economic, and financial, costs and benefits. Hence, the economic and financial internal rates of return for the Project will be recalculated on the basis of the information provided to the mission team, upon returning to Bank Headquarters.

7. **Energy Conservation Study**. In addition to the physical objective relating to the construction of the pipeline network, the Project also had an objective of developing an appropriate energy conservation program for Korea. This objective was to be achieved through a major consultancy Study, that would also contain an action plan implementable by the Government. The Study comprised two phases, and the successful completion of Phase I was a condition of Board presentation. However, developing the TOR for Phase II involved extensive negotiation between the Bank, the Government and DOPCO, and the problems experienced in defining the TOR, and subsequently in selecting consultants, delayed this component of the Project considerably. This delay resulted in the need for a second extension of the loan closing date, from December 1997 to December 1998.

8. It was eventually agreed that the Phase II report would comprise the following tasks: (1A) an evaluation of energy pricing in Korea; (1B) the development of a methodology for energy conservation evaluation; (2A) the preparation and execution of an intensive energy conservation training workshop for MOCIE staff; (2B) the development of an effective demand side management (DSM) approach for Korea's transportation sector; (3) an evaluation of energy conservation programs; and (4) the development of a management program and strategic plan for DOPCO. It was decided that MOCIE was the more appropriate agency to take the lead role in overseeing the consultants for all tasks, with the exception of Task 4. Although conducted within the scope of the Energy Conservation Study, Task 4 was designed to complement the other efforts directed at achieving the institutional strengthening objective (para. 11). Hence, oversight of this task was retained by DOPCO.

9. The final draft report was submitted during December 1998, and subsequently the Bank received comprehensive comments from MOCIE on the relevant sections of the report in January 1999. However, the Bank agreed that MOCIE's comments were significant enough to be taken into account in the final version, and hence provided its no objection to the final report being submitted in March 1999, on the condition that this did not impact on the consultancy fee. The consultants have agreed to modify the report accordingly. DOPCO preliminarily indicated to the mission that Task 4 of the report has been very useful for the Corporation's management, particularly in clearly identifying some of the issues that need to be addressed in order to improve DOPCO's financial position (para. 12). The mission requested that DOPCO provide detailed comments on Task 4 by March 1, 1999.

10. The mission met with MOCIE staff to discuss how the recommendations of the Phase II report are likely to be implemented in the future. In response, MOCIE staff indicated that the financial crisis

has provided a major impetus to public sector reform in Korea, and to a recognition by the Government of the value of separating out the policy and regulatory functions of the Government as well as the state-owned corporations. MOCIE itself will be reorganized shortly, and international consultants have been hired to provide recommendations on the establishment of an energy sector regulatory body (or bodies), which would, at least initially, report to MOCIE. The Government also intends restructuring the power and gas sectors in parallel, and international consultants have provided initial reports with restructuring plans for each sector. Part of the restructuring would most likely involve the separation out of policy functions vested within energy sector corporations. Such policy functions would include many energy conservation activities, but no decision has yet been made on how such activities would be consolidated with similar functions currently vested within MOCIE and other Government entities. Hence, MOCIE indicated that the current state of flux within the sector entities precludes immediate adoption of many of the recommendations outlined in the Energy Conservation Study.

11. **Institutional Strengthening Components.** In addition to the physical and sectoral objectives outlined above, the Project had the objective of strengthening the financial, operational and managerial capabilities of DOPCO. This objective was to be achieved through the provision of technical assistance (a) to help DOPCO design and implement a management information system (MIS), and (b) for training of DOPCO staff in the critical areas of operations, finance and management. DOPCO indicated that it had not utilized the portion of the loan allocated for MIS since Bank procedures for the hiring of consultants, particularly for relatively small contract amounts, were seen as cumbersome. However, DOPCO did proceed with the development of the MIS as originally envisaged, but self-financed this component. With respect to training, DOPCO indicated that about 50 staff attended various technical and non-technical training courses through the use of the loan. The mission requested that DOPCO provide the Bank with a summary of the nature and impact of the training programs financed under the loan, by March 1, 1999.

Project Sustainability

12. The mission expressed concern at DOPCO's low revenues, caused by the Corporation's low market share for the transportation of petroleum products, and consequently at the poor overall financial position of the Corporation. DOPCO indicated that the Corporation's action plan to address its financial difficulties comprises: (i) increasing sales volume, as a result of joint negotiations between DOPCO, the Government (as majority shareholder) and the refineries (being both customers and minority shareholders); (ii) improving the Corporation's financial structure, by seeking debt/equity conversion and temporary debt forgiveness from the Government, and also by extending the pipeline depreciation period; and (iii) making the Corporation's management system more efficient, through restructuring and downsizing.

13. The mission discussed with both DOPCO and KEEI the financial difficulties facing DOPCO, in order to determine some of the major factors producing such an undesirable situation. It was agreed that in the longer term, the sustainability of DOPCO's operation should be good, since international experience demonstrates that, when operated close to capacity, pipelines are more economic than other transportation modes over long distances. In addition, pipelines have significant environmental and safety benefits. However, the present level of pipeline capacity utilization is unsustainable, since the pipeline tariff would need to be significantly higher than alternative transportation modes for DOPCO to adequately service its debt.[1] The low capacity factor has also detrimentally affected the quality of

[1] The current utilization factor of DOPCO's pipeline network is around 34%. In Task 4 of the Phase II report for the Energy Conservation Study (para. 7), it is estimated that, for DOPCO to become a viable operation, the capacity utilization must increase to at least 55-60%.

transportation service, evidenced by a significant increase in product transit time through the pipeline.[2] During off-peak periods, pipeline transit time can be as much as 10 days, whereas coastal vessels can ship the product within a day.

14. The key factors detrimentally affecting the Project were preliminarily identified as being: (i) the incapacity of DOPCO to come to a satisfactory agreement with the refineries on utilization of the pipeline; and (ii) the onset of the regional financial crisis. The lack of agreement with the refineries on pipeline utilization has meant that DOPCO's market share has been significantly lower than expected. Hence, DOPCO has received minimal revenues at a period when it still has significant debt service obligations. Full commissioning also occurred not much before the beginning of the crisis. The crisis itself caused a drop in domestic petroleum demand,[3] and the refineries have since faced low operating rates (and as a result are discussing possible mergers). Furthermore, since the onset of the crisis, refineries have not been well placed to switch to pipeline use from other transportation modes. This is because the crisis has raised barriers to exit from the petroleum product transportation market (for alternative modes), due to the difficulty that the refineries face in divesting their coastal vessels, tanker trucks and rail cars.

15. At Project appraisal, DOPCO's future financial position looked secure, since the Korean Regulation for Oil Transportation (1993) requires any user of DOPCO's pipeline network to enter a take-or-pay agreement with DOPCO. However, in practice, the quantities of petroleum products to be transported which the refineries have nominated, have been insufficient to ensure DOPCO's operational and financial viability. Apart from the crisis, another contributing factor might have been the announcement by the Government of its medium-term plan to fully privatize DOPCO. Potentially this might have provided an incentive to any refinery that has an interest in increasing its relative stake in DOPCO to drive the share price down.

16. DOPCO indicated to the mission that MOCIE is now coordinating negotiations between DOPCO and the refineries, since the Government has two clear motivations for increasing the capacity utilization of the pipeline network. Firstly, the Government recognizes that utilization of the pipeline is in the national interest, for both environmental and economic reasons. Secondly, the Government desires to receive reasonable proceeds from DOPCO's eventual privatization. Preliminary indications are that the refineries will agree to a three year transition period during which utilization of the pipeline will be gradually increased. DOPCO agreed to keep the Bank informed of the outcome of these ongoing discussions.

Operational Plan

17. DOPCO and the mission agreed to continue using DOPCO's financial statements as measures of the ongoing sustainability of the project, since they reflect DOPCO's market share, revenue and cost effectiveness. The mission requested that DOPCO continue to provide the Bank with both its audited and unaudited financial statements upon request.

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[2] The pipeline handles four types of petroleum products, and each type of product is shipped through the pipeline in batches. When the batches are pumped through the pipeline, interfaces form at each of the product joints, and the amount of product contamination at the interfaces increases with the number of batches. Hence, to reduce contamination, products must be stored until sufficient quantities are available to make sufficiently large batches.

[3] Primary energy consumption in Korea decreased by 7% in 1998, petroleum demand was down by 14%, and oil imports reduced by about 35%.

Implementation Completion Report

1. Objetive

o To make a stable supply of oil products by establishing economic and efficient pipeline transportation system
o Contribution to the preventing environment pollution and heavy traffic.

2. Necessity

o It is not evitable to transport oil products in a long distance, for the refineries are far from consuming districts.
o Social overhead capital such as roads or ports is not sufficient in its capacity when oil products are tansported by means of oil trucks and oil tankers..
o So it is necessary to construct a long pipeline connecting the manufacturing plants with consuming districts to make a stable supply of oil products, which are an essential energy source.

3. Chronology

o '90. 1. 13. The National Assembly enacted " Oil Pipeline Business Law "
o '90. 1. 15. Established Investment Agreement among 5 Refineries and 2 Airlines by MOCIE.
o '90. 1. 20. DOPCO was established
o '90. 11. 13. Anounced 「National Wide Oil Pipeline Project」
o '90. 12. 19. Started construction 「Kyungin Line」
o '91. 12. 17 Started construction 「South-North Line」
o '92. 12. 14 Kyungin oil pipeline was completed and opened for operation
o '95. 6. 21 Daejeon terminal was completed and started operation
o '97. 6. 30 Sungnam terminal was completed and nationwide oil pipeline system came into full operation
o '98. 7. 31 Acquired Korea Oil Pipeline Co., Ltd.

4. Pipeline operation

o The whole operating procedure, for example transmission and storage etc., is controlled automatically by SCADA, the monitoring and remote control system, in the Central Control Center.

The volumes, pressure, temperature and storing volumes are checked automatically by SCADA system from the injection point to the delivery point and when in an emegency related pumps and valves are operated automatically.

o Light oil(gasoline, diesel, kerosene, jet oil)is transmitted on a pipeline according to the predetermined order without cease.

- The mixed portion of oil products, actually a little and acceptable amount, is sent to reserved tanks in the terminal and reprocess it

5. The role of DOPCO

Contribution to the economic development
by building up the advanced oil products transportation system

o Reducing the oil products transportation expenditure

-Over 70% of nationwide oil products transportation volumes is expected to be carried out through pipelines and result in saving about 77billion won a year.

o Oil storage effect

Expecting 3.5million barrel storage, equivalent to 5day's domestic consumption of light oil

Enlarging the ability to cope with a national emergency.

o Expecting the effect of reducing the investment in the social overhead capital

- The rate of traffic congestion can be diminished by 3% and the required amounts of investment in roads, 1.3trillion won, can be saved.
- About 7,000 oil trucks a day can be decreased on the highways.

o Contribution to the improvement of national life by easing environmental pollution

- Reducing the number of oil trucks and oil tankers result in easing sea contamination and air pollution.

o The accumulation of technology in oil products transportation

- Design, construction and operation by domestic technical manpower can lead to the independence of technology.

6. Check point

o The accurate calculation of the throughput to secure profitability.
As throughput is an important basic data for deciding the scale of an investment in facilities and for the toll design, the contract of it makes it possible to secure the profitability.

o Stability in finanacial structure makes financing easy
- The financial expenses such as interest arise due to the initial large scale of borrowings

o Deciding the site and getting permits
- The constructing schedule is delayed by conflicts with the dwellers.

7. Problem rising from the low pipeline utilization rate

o The South-North pipeline operation rate is only under 20%.
- As the pipeline business is capital intensive industry which requires the initial enormous investment, the percentage of fixed cost such as interest expense, facilities maintenance and wages out of the total cost is over 95%.
- An unit fixed cost can be cut down and the tariff can be lowered as the throughput increases. Now the utilization rate of the pipeline is so low, thus the tariff is required to be raised.

o Through a single pipeline several kinds of refined products, gasoline, diesel, kerosene and jet oil, are transported. This causes a certain amount of the mixture and additional expense.

o For the pipeline facilities are not used frequently, the alloction of resources are not suitable.

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F a c s i m i l e

Date : April 30, 1999 **No. of page : 1** (including this page)

Attention : Mr. Mohammad Farhandi
Principal Energy Specialist
EASEG
The World Bank

Subject : Implementation Completion Report

Dear Mr. Farhandi,

Thank you for your sincere cooperation.

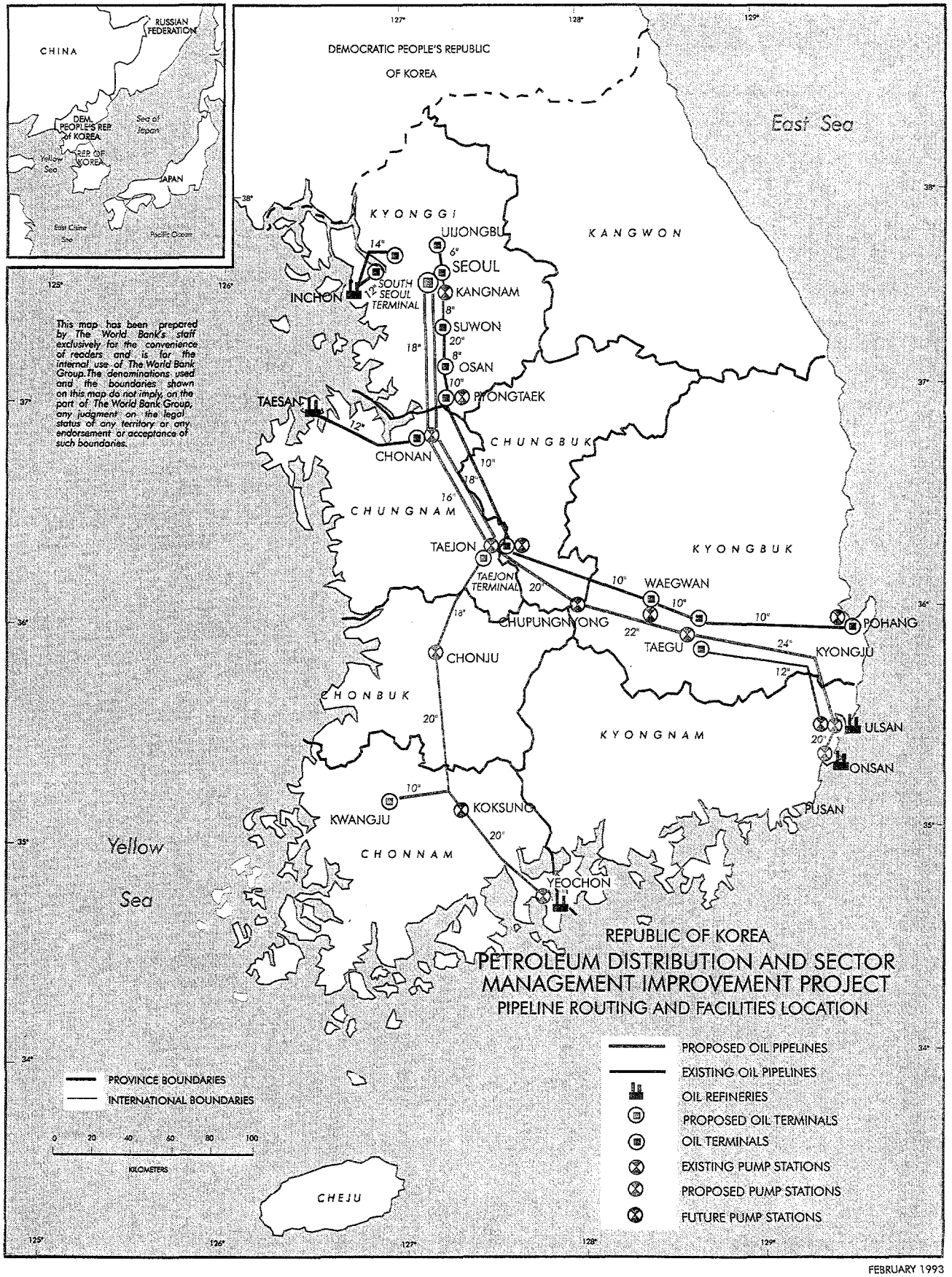
Regarding your fax of April 9, 1999, we examined the Draft Implementation Completion Report you prepared thoroughly.

We think this report is sufficient to understand our Petroleum Distribution and Sector Management Improvement Project.

Sincerely yours,

Susung Kim
Financial Director
Planning & Coordination Department
DOPCO

IBRD 24104



REPUBLIC OF KOREA

PETROLEUM DISTRIBUTION AND SECTOR MANAGEMENT IMPROVEMENT PROJECT

PIPELINE ROUTING AND FACILITIES LOCATION

FEBRUARY 1993